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(12) UK Patent Application (19) GB (11) 2 218 372 (13) A

(43) Date of A publication 15.11.1989

(21) Application No 8910916.9

(22) Date of filing 12.05.1989

(30) Priority data
(31) 63117191 (32) 13.05.1988 (33) JP

(51) INT CL⁴
B29C 69/02

(52) UK CL (Edition J)
B5A AA1 A1R314C3 A1R322 A1R405 A2A1 A2A2 A2E4X A20T1 A20T14
U1S S1156

(56) Documents cited
None

(58) Field of search
UK CL (Edition J) B5A AA1 AA3 AL1 AT1P
INT CL⁴ B29C

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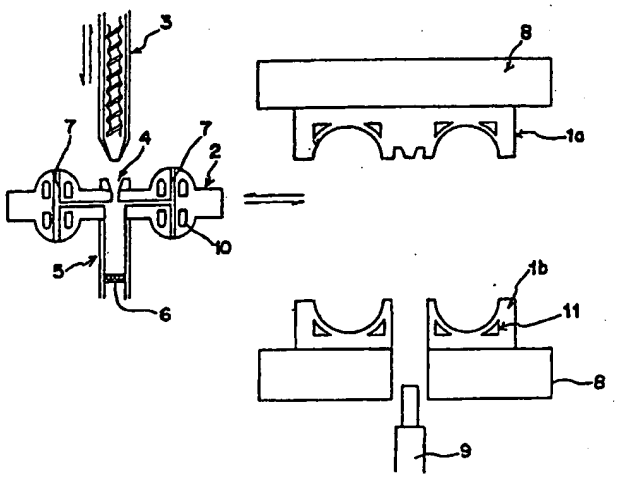
(54) Moulding a multilayer spherical article

(57) An apparatus for producing a multilayer spherical article comprises hemispherical molds (1*a* and 1*b*) and an inner mold (2) having hemispherical projections which correspond to the shape of a desired core (not shown) whereby an outer layer composition, for example a rubber or resin composition, can be fed into half shell spaces between the hemispherical molds (1*a*, *b*) and the inner mold (2) to form two half shells, and the inner mold is then removed and replaced by said core and the half shells and core are thereafter molded to form a multilayer spherical material. The inner mold has an inlet (4) for the outer layer composition which is supplied from an extruder (3), a transfer pot (5) having a movable plunger receiver (6) for transiently storing the outer layer composition, and an outlet (7) through which the composition can be introduced into the half shell spaces by depressing the plunger receiver (6) by a plunger (9).

Fig. 1



At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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Fig. 1

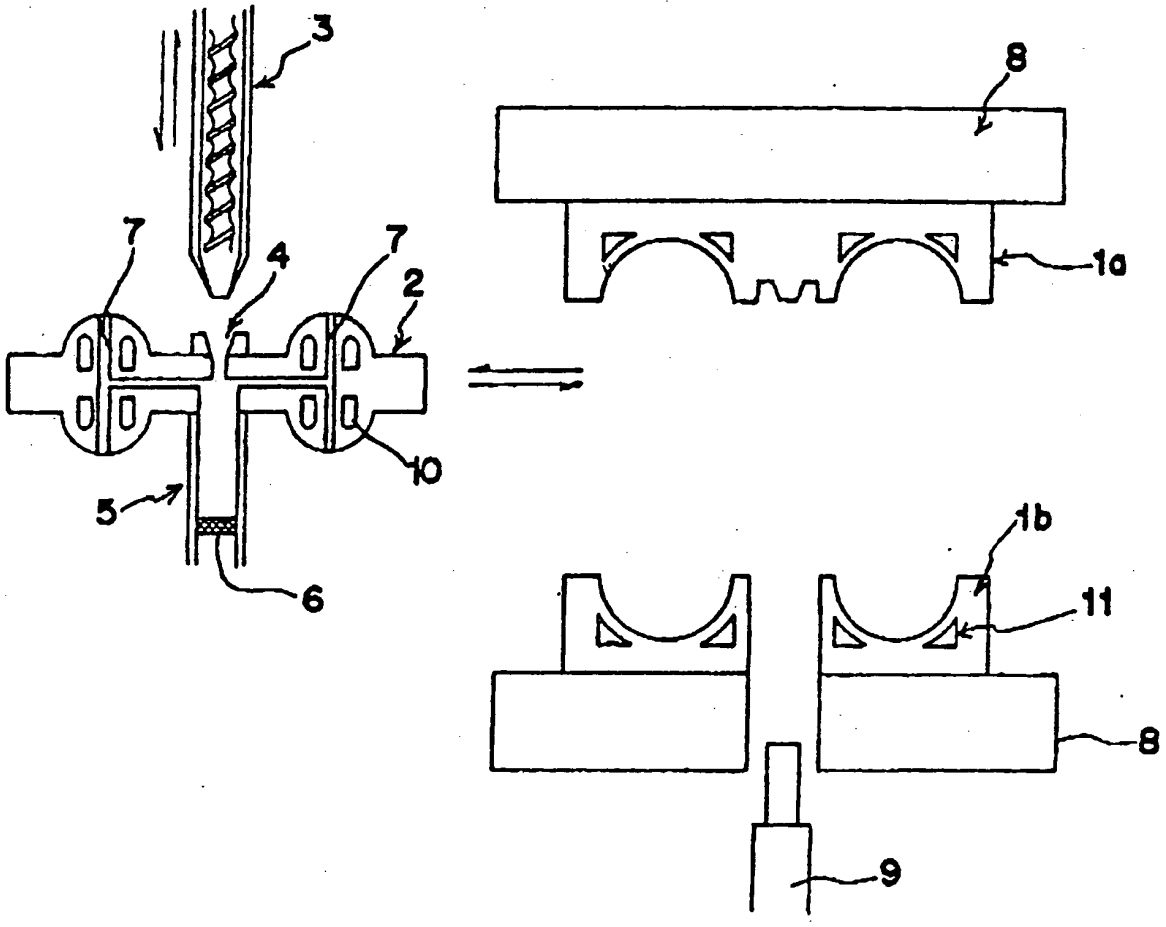

Fig. 2

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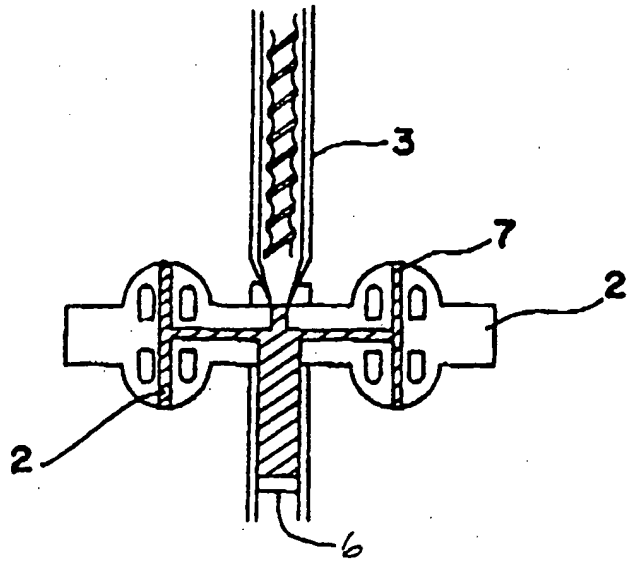

Fig. 3

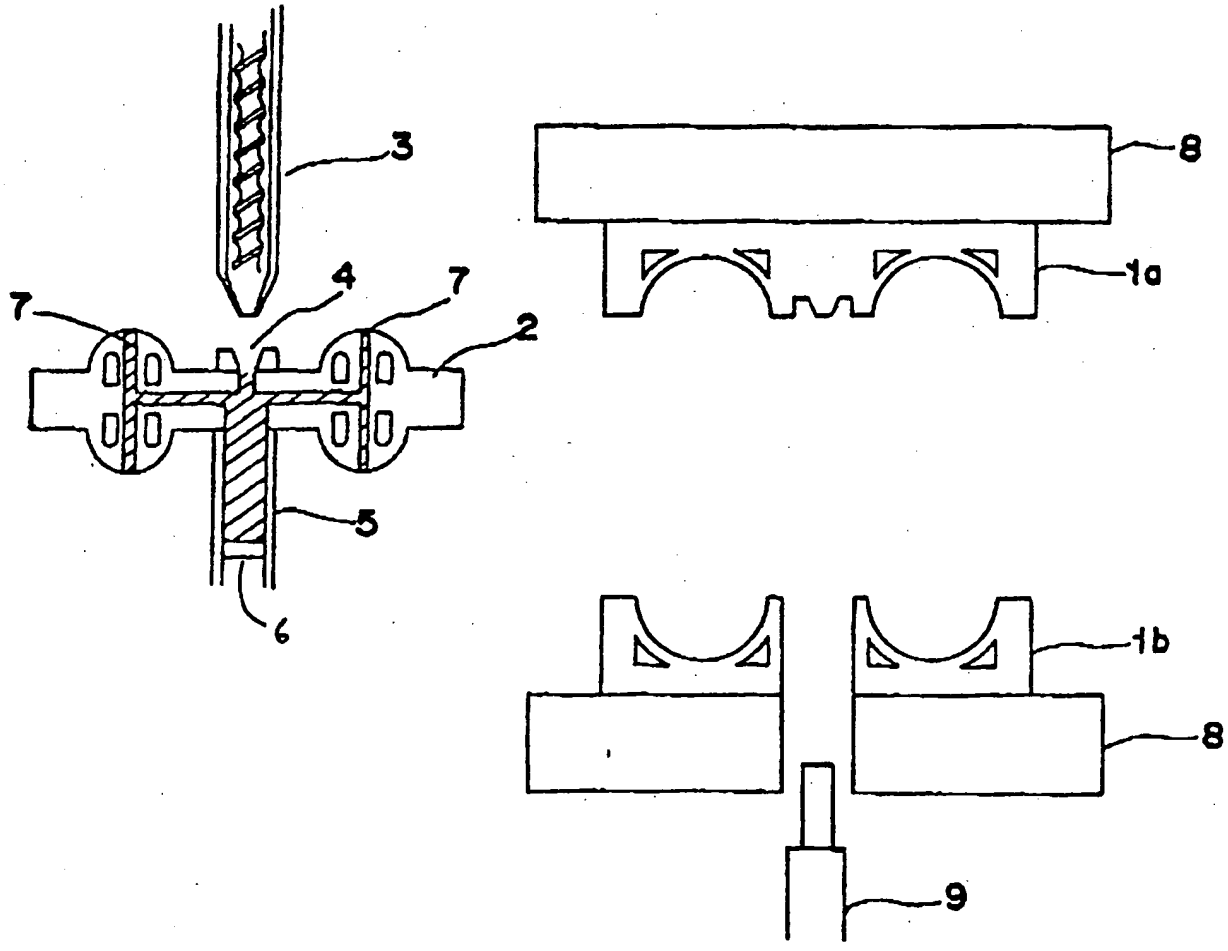

Fig. 4

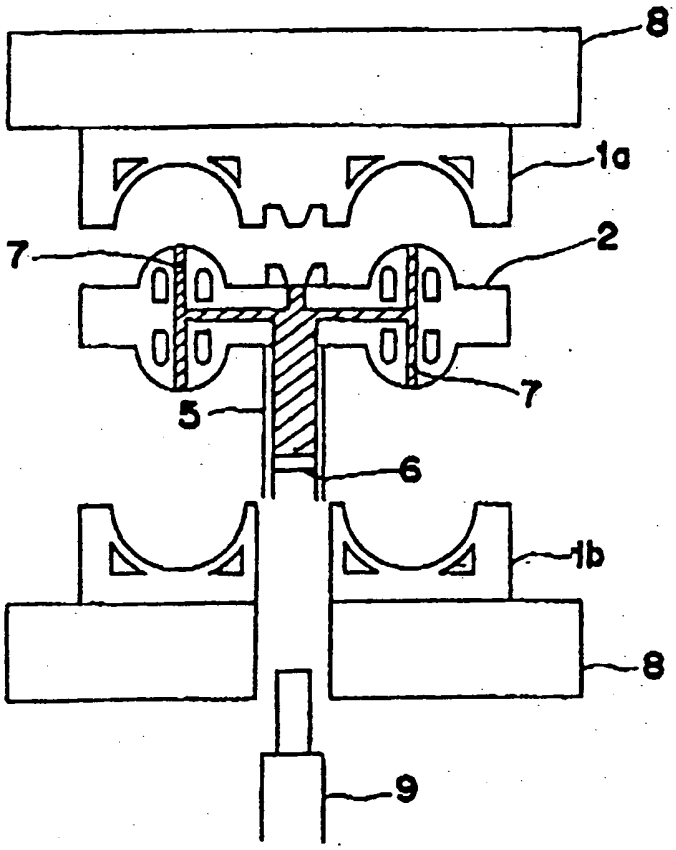

Fig. 5

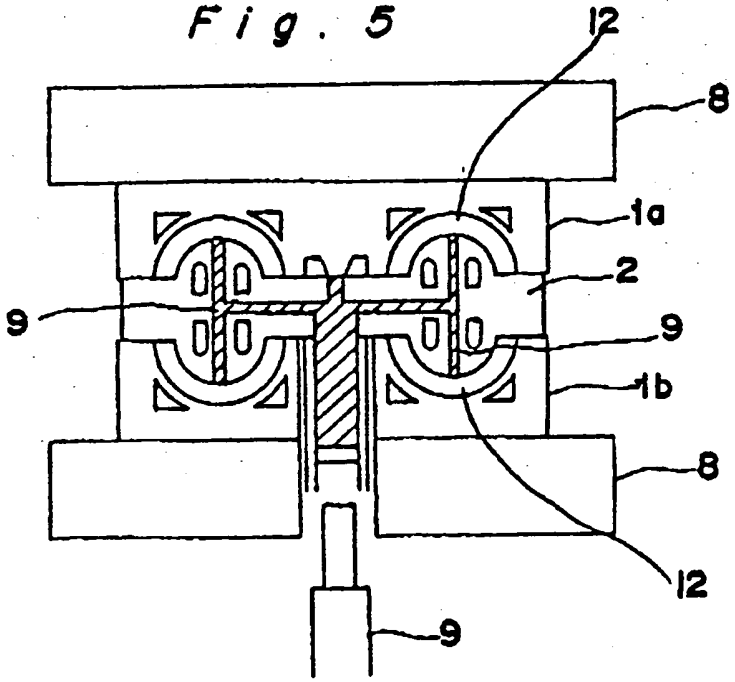

Fig. 6

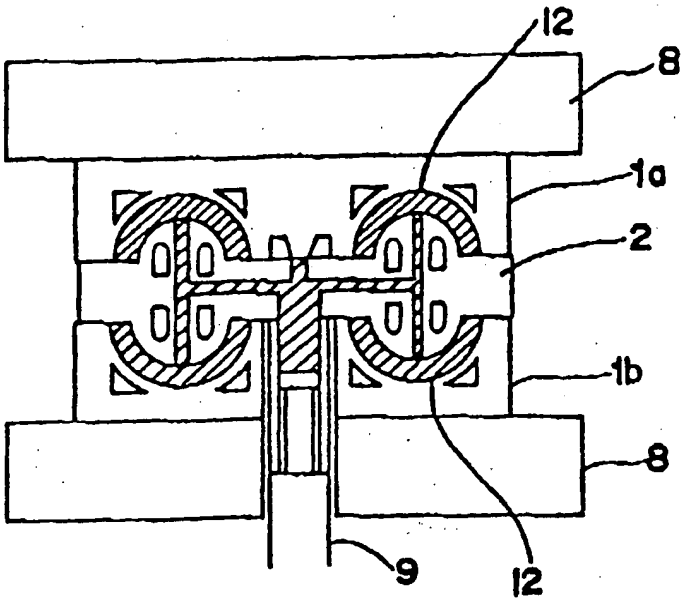

Fig. 7

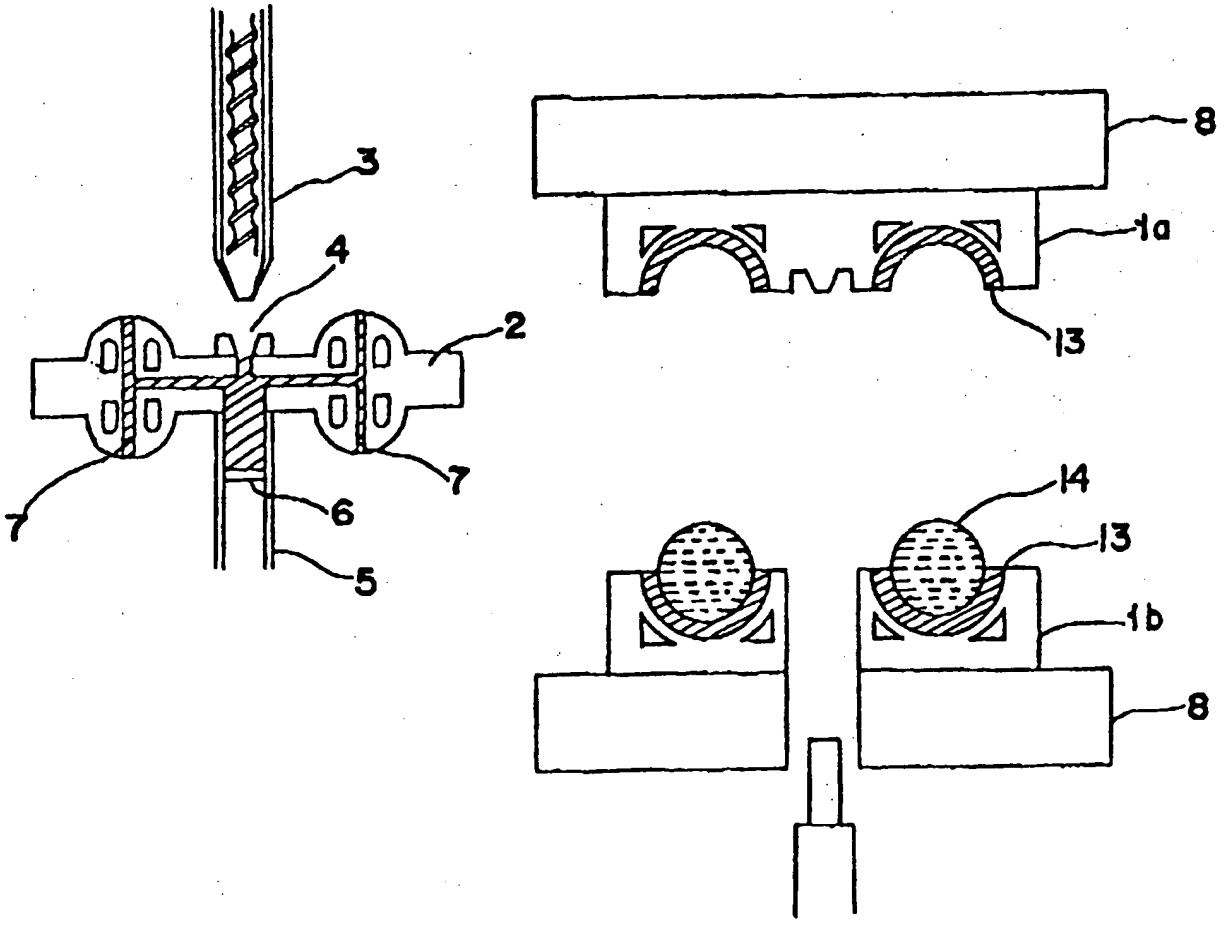

Fig. 8

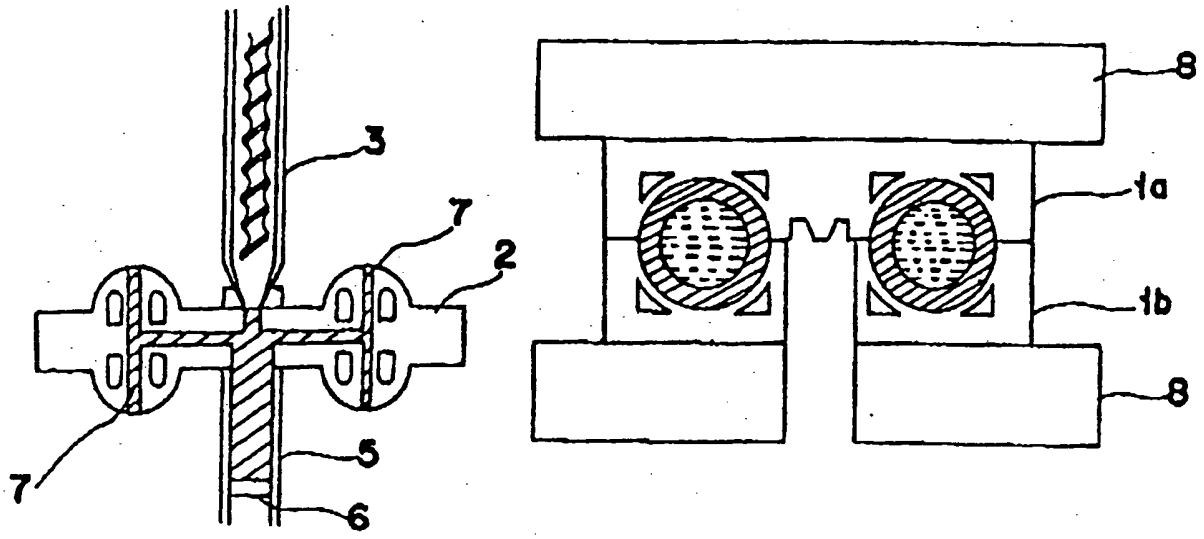

Fig. 9

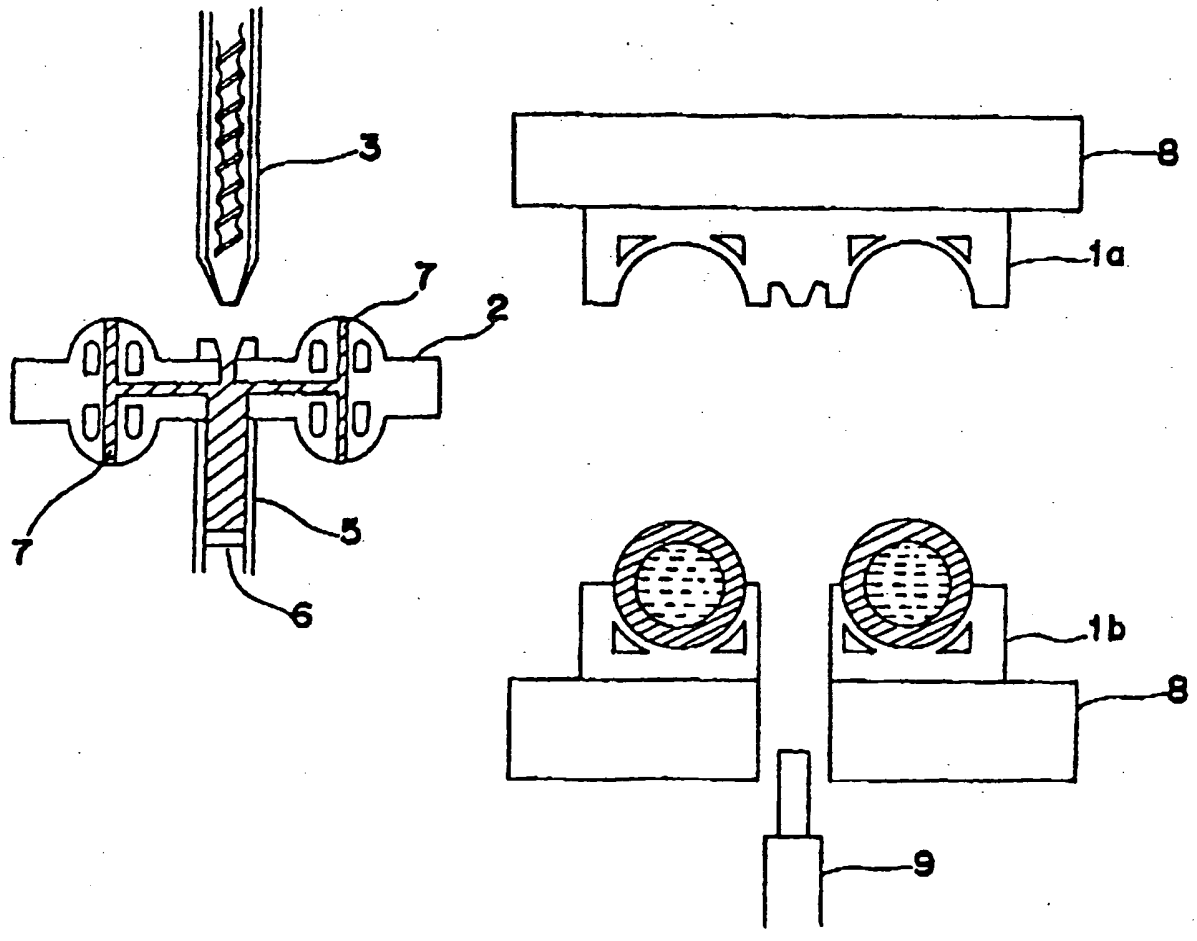

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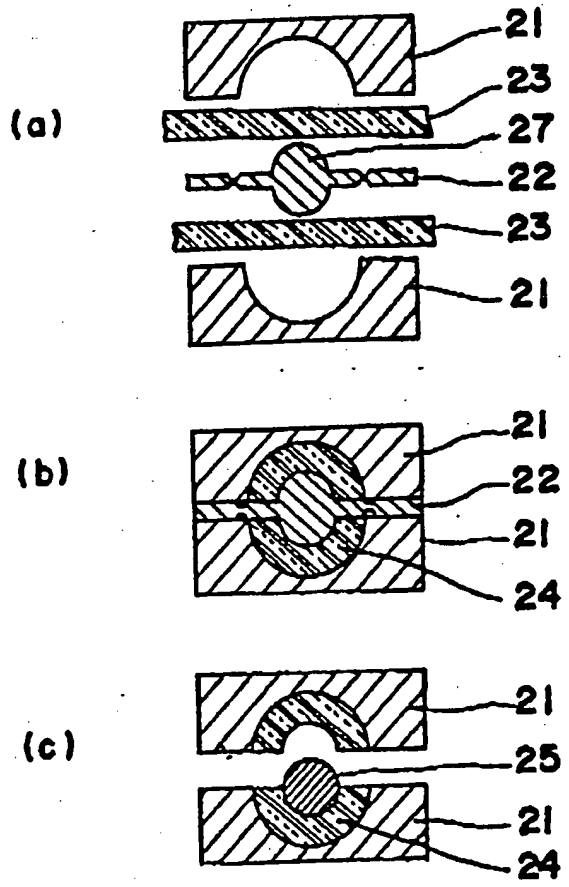
Fig. 10
Prior Art



APPARATUS AND PROCESS FOR PRODUCING A MULTILAYER RUBBER SPHERICAL MATERIAL

The present invention relates to an apparatus for producing a multilayer rubber spherical material and a method for producing the same.

A thermoplastic resin changes its flowability when heated, but a rubber composition has poor flowability even at an elevated temperature. Due to the poor flowability, it is difficult to obtain a multilayer spherical material, such as a multilayer golf ball, from rubber compositions using injection molding and the like.

Japanese Kokai Publication (unexamined) 73932/1987 discloses a method for producing such a multilayer spherical material. In this method, as shown in Fig. 10 (a) to (c), an outer layer rubber composition 23 is molded between an inner mold 22 having hemispherical projections 27 equal to the shape of a core 25 and up and down hemispherical molds 21 to form uncured or semi-cured half shells 24, which are then integrally molded with the core 25 instead of the inner mold 22 to obtain a multilayer spherical material. The method quite successfully produces a multilayer spherical material, but still has some drawbacks which could be improved for example in productivity, large wastage of the rubber composition and the like.

The present invention provides an excellent method and apparatus for producing a multilayer rubber spherical material.

The present invention provides an apparatus for producing a multilayer rubber spherical material comprising up and down semispherical molds and an inner mold having up and down semispherical projections which fit the shape of a core wherein an outer layer rubber composition is poured into half shell spaces between the semispherical molds and the inner mold to form two half shells, the inner mold is taken out, a preliminary prepared core was put in instead of the inner mold and molded to form a multilayer rubber spherical material; an improvement being residue in that said inner mold has an inlet for directly pouring the outer layer rubber composition into said half shell spaces from an extruder, a transfer pot having a movable plunger receiver for transiently storing the poured outer layer rubber composition from said inlet, and an outlet for introducing said stored rubber composition into the half shell spaces by pressing the plunger.

The present invention also provides a process for producing a multilayer rubber spherical material comprising molding an outer layer rubber composition in half shell spaces between up and down semispherical molds and an inner mold having up and down semispherical projections which fit the shape of a core to form two half shells, taking the inner mold out and introducing a core before molding,

wherein said half shells are prepared by pouring the rubber composition into a transfer pot having a movable plunger receiver through an inlet from an extruder, replacing said inner mold in said semispherical mold, pressing said plunger receiver by a plunger in the mold to introduce said rubber composition in the transfer pot into said half shell spaces through an outlet.

The invention will now be described by way of example with reference to the accompanying drawings in which:

Fig. 1 is a sectional view of the apparatus of the present invention.

Figs. 2 to 9 show the process of the present invention.

Fig. 10 (a) to (c) shows the process of the prior art (Japanese Kokai Publication 73932/1987).

Figure 1 is a sectional view of the apparatus of the invention while Figures 2 to 9 show that apparatus in use in the various steps of the process of the invention. The same features in the various drawings are indicated by the same numbers.

Figure 1 shows an inner mold 2 having an inlet 4, a transfer pot 5 with a plunger receiver 6, and outlets 7. An extrusion head 3 is also shown. Also shown in Figure 1 are upward and downward hemispherical molds 1a and 1b supported by pressure plates 8. A plunger 9 is also illustrated. Pipes for heating or cooling medium in the inner mold 2 or upward and downward molds 1a and 1b are shown as 10 and 11 in the drawings.

As shown in Figures 2 and 3, an outer layer rubber composition is poured into a transfer pot 5 of an inner mold 2 through an inlet 4 from an extruding

head 3 of an extruder (not shown in the drawings). The transfer pot 5 has a movable plunger receiver 6. In this process, the inner mold 2 is filled with the outer layer rubber composition.

The inner mold 2, as shown in Figs. 4 and 5, is placed in upward and downward hemispherical molds 1a and 1b to form half shell spaces 12. Then, a plunger 9 presses the plunger receiver 6, as shown in Fig. 6, and the outer layer rubber composition in the inner mold 2 is introduced into the half shell spaces 12 through outlets 7 to form four half shells. In this process, the inlet 4 of the inner mold 2 may be closed by a suitable means (not shown in the drawings) to prevent a back flow of the rubber composition. In Fig. 6, the upward and downward molds 1a and 1b or the inner mold 2 may be heated to semi-cure the rubber composition, if necessary. Of course, the half shells may be prepared by compression-molding without heating. In Figs. 3 to 9, the number 8 indicates a pressure plate for applying pressure. The inner mold 2 may be coated with a releasing agent.

Next, the plunger 9 is released and the upward and downward molds 1a and 1b are opened before removing the inner mold 2. Cores which have been prepared beforehand are placed onto the upward half shells, while pouring of further outer layer rubber composition into the transfer pot 5 begins in the inner mold 2.

Figure 8 shows integral molding of the cores 11 and the half shells 13. Simultaneously, further outer layer rubber composition is poured into the transfer pot 5 of the inner mold 2 from the extruding head 3. The integral molding can be conducted under

conditions which are varied to suit the type of the rubber composition, but usually at a temperature of 140 to 170°C for 15 to 40 minutes. In this process, a curing condition in which complete curing does not occur may be selected if necessary. In a case where complete curing does not occur, the obtained multilayer spherical material can itself be used as a core 14 and the process of the present invention may be repeated again to form a spherical material having more than two layers.

In Figure 9, the molds 1a and 1b are opened to obtain a multilayer spherical rubber material. Simultaneously, beside the molds, the pouring of the rubber composition into the transfer pots is finished. This means that, if the obtained rubber material is taken out, the next production process can be conducted immediately.

The apparatus and production process of the present invention can be used for producing bowling balls, golf balls (e.g. solid multi-piece golf balls and wound golf balls), balls for rubber ball baseball or rigid ball baseball, tennis balls, cricket balls, gate balls, basketballs and the like. The outer layer rubber composition can be replaced by other materials, such as synthetic resin and the like.

The above description is directed to the apparatus and process of two rubber balls, but the present invention is not limited to this. The present invention may cover an apparatus and process for producing one rubber ball, as well as for producing more than two rubber balls.

According to the present invention, a multilayer spherical material can be produced at a high productivity and the center of gravity can be suited to the center point of the material.

CLAIMS

1. Apparatus for producing a multilayer spherical material comprising upward and downward hemispherical molds and an inner mold having upward and downward hemispherical projections which fit the shape of a desired core whereby an outer layer composition can be poured into half shell spaces between the hemispherical molds and the inner mold to form two half shells, and the inner mold then removed and replaced by a core and the half shells and core thereafter molded to form a multilayer spherical material, characterised in that the inner mold has an inlet for the outer layer composition to be supplied from an extruder, a transfer pot having a movable plunger receiver for transiently storing the outer layer composition supplied through the inlet, and an outlet through which stored composition can be introduced into the half shell spaces by depressing the plunger receiver.

2. Apparatus according to Claim 1 characterised in that the inner mold is coated with a releasing agent.

3. Apparatus for producing a multilayer spherical material substantially as described herein other than as prior art.

4. Apparatus for producing a multilayer spherical material substantially as illustrated in Figure 1.

5. A process for producing a multilayer spherical material comprising molding an outer layer composition in half shell spaces between upward and downward hemispherical molds and an inner mold having upward and downward hemispherical

projections which fit the shape of a desired core to form two half shells, removing the inner mold and replacing it with a core and then molding to form a multilayer spherical material, characterised in that the half shells are prepared by supplying the outer layer composition from an extruder into a transfer pot having a movable plunger receiver through an inlet in the inner mold, transiently storing the composition in the plunger receiver and then depressing the plunger receiver with a plunger to introduce composition from the transfer pot into the half shell spaces through an outlet in the inner mold.

6. A process as claimed in claim 5 characterised in that the outer layer composition comprises a rubber composition.

7. A process as claimed in claim 5 characterised in that the outer layer composition comprises a synthetic resin.

8. A process for producing a multilayer spherical material substantially as described herein other than as prior art.

9. A process for producing a multilayer spherical material substantially as illustrated in Figures 2 to 9.

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